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The role of pain in quitting among human immunodeficiency virus (HIV)–positive smokers enrolled in a smoking cessation trial

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Abstract

Background: Smoking rates among people living with human immunodeficiency virus/acquired immunodeficiency syndrome (HIV/AIDS; PLWHA) are at least twice as high as rates in the general population. Consistent with the reciprocal model of pain and smoking, PLWHA with pain who smoke may use smoking as a means of coping with pain, thus presenting a potential barrier to quitting. The aim of this study is to better understand how pain relates to smoking cessation among 474 HIV-positive adults enrolled in a cell phone–delivered smoking cessation trial.

Methods: Participants were randomly assigned to usual care (cessation advice and self-help materials) or 11 sessions of cell phone–delivered smoking cessation treatment. Pain, as assessed by the Medical Outcomes Study-HIV Health Survey (MOS-HIV), and point prevalence abstinence were collected at the 3-month treatment end and at 6- and 12-month follow-ups. Self-reported abstinence was biochemically verified by expired carbon monoxide (CO) level of <7 ppm.

Results: Using multilevel modeling for binary outcome data, the authors examined the relationship between pain and abstinence, from treatment end through the 12-month follow-up. Consistent with the authors' hypothesis, less pain was associated with greater likelihood of 24-hour ($\beta = .01$, $t(651) = 2.53$, $P = .01$) and 7-day ($\beta = .01$, $t(651) = 2.35$, $P = .02$) point prevalence

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Author contributions

Dr. Aigner made substantial contributions to the design and interpretation of the work and is the primary author of the manuscript. Drs. Gritz, Tamí-Maury, Arduino, and Vidrine all made substantial contributions to the design and/or interpretation of the work and all contributed to the critical evaluation and revision of the manuscript. Mr. Baum made a substantial contribution to the analysis and interpretation of the work and the critical evaluation and revision of the manuscript.

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abstinence, controlling for age, gender, baseline pain, nicotine dependence, and treatment group. No pain × treatment group interaction was observed.

Conclusions: These results can help us to better identify PLWHA at greater risk for relapse in smoking cessation treatment. Future research may examine the effectiveness of more comprehensive smoking cessation treatment that incorporates aspects of pain management for PLWHA who smoke and have high pain and symptom burden.

Keywords

HIV-positive smokers; pain; smoking cessation; symptom management

Introduction

Smoking rates among people living with human immunodeficiency virus/acquired immunodeficiency syndrome (HIV/AIDS; PLWHA) are at least twice as high as rates in the general population.[1] Smoking among PLWHA is linked to many negative health effects, including poorer adherence and response to antiviral treatment[2] and increased risk for the development of many smoking-related chronic diseases.[3,4] These findings highlight the need for a better understanding of the factors that relate to smoking and quitting among PLWHA.

PLWHA may experience a wide range of symptoms, including pain, related to the disease or treatment process. Pain is highly prevalent among PLWHA, with research reporting rates of pain among PLWHA ranging from 30% to 80%.[5] One study found that the most commonly endorsed pain complaints among PLWHA undergoing antiviral treatment were stomach pain, headache, muscular pain, and oral pain, respectively.[6] Pain is an important component of the overall symptom burden experienced by PLWHA and is linked to higher levels of psychological distress and lower quality of life among PLWHA.[7]

Pain is of added clinical significance given that pain and HIV/AIDS symptom burden have been linked to smoking status among PLWHA. Research demonstrates that PLWHA who smoke endorse higher pain and symptom burden than those who do not smoke.[3] This is consistent with research demonstrating higher rates of smoking among people with chronic pain in the general population.[8,9] Thus, understanding how pain and symptom burden relate to smoking and quitting among PLWHA may help us to better understand the high rates of smoking found in this population.

The reciprocal model proposes that the relationship between pain and smoking is characterized by bidirectional influences.[8] First, chronic smoking can exacerbate pain[8] and quitting may help to ameliorate pain.[10] Secondly, pain is believed to motivate smoking. Some smokers may perceive smoking as a means of coping with pain (although smoking may exacerbate pain conditions in the long term).[8,11] Consistently, pain may also make it more difficult to quit smoking. Although not yet examined among PLWHA, there is initial support for this hypothesis among cancer patients with pain. An electronic daily diary study found that daily pain was associated with greater daily smoking among cancer patients trying to quit, and that patients with higher pain were less likely to make a quit attempt.[12] If

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pain poses a similar barrier to quitting among PLWHA, this information can be used to identify and target smokers at greater risk for relapse in smoking cessation treatment.

To our knowledge, the influence of pain on quitting smoking has not been examined among PLWHA. Given the high pain and symptom burden and high rate of smoking present in this population, this is an important area for further examination. The aim of the current study is to gain a better understanding of how pain may relate to smoking cessation outcomes among HIV-positive adults who are enrolled in a cell phone–delivered smoking cessation trial. We hypothesize that those individuals with less pain will have better quit outcomes throughout the posttreatment follow-up period. A greater understanding of the factors that contribute to difficulty quitting among PLWHA will help in designing more effective smoking cessation interventions for this population.

Methods

This paper presents partial findings from a randomized controlled trial of a cell phone–delivered smoking cessation intervention for PLWHA. The outcome data for the randomized controlled trial are published elsewhere.[13,14]

Participants

Participants were 474 PLWHA who were currently receiving care at the Thomas Street Health Center in Houston, Texas. Eligibility requirements included status as a current tobacco smoker (smoking ≥5 cigarettes per day and expired carbon monoxide level of ≥7ppm), HIV-positive status, and willingness to set a quit date within 7 days. PLWHA who were currently receiving smoking cessation treatment through other programs were excluded.

Study design and procedures

Participants completed a baseline assessment consisting of several smoking- and symptom-related measures. Participants were then randomized into either the usual care (UC) or the cell phone intervention (CPI) groups. Of the 474 participants enrolled in the study, 238 and 236 were randomized to the UC and CPI groups, respectively. Participants in both groups received brief advice from the clinician for quitting smoking, self-help written materials, and information about nicotine replacement therapy. Nicotine replacement therapy (NRT) patches were provided free of charge to all participants enrolled in this study (both UC and CPI groups). The UC group received no further treatment. Participants in the CPI group received 11 cell phone–based counseling sessions, designed from a cognitive-behavioral framework. Abstinence data were collected at 3 months (treatment end) and 6- and 12-month follow-ups. More detailed information regarding the intervention and study procedures can be found in Vidrine et al.[13]

Measures and assessments

The Medical Outcomes Study-HIV Health Survey (MOS-HIV) is a widely used and well-validated measure of health-related quality of life among PLWHA. The 35-item measure includes 10 subscales that assess multiple dimensions of health, including symptoms

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specific to HIV/AIDS and other, more general symptoms. Standardized MOS-HIV subscale scores range from 0 to 100, with higher scores indicating better functioning in each domain.[15] Internal consistency for each of the subscales is good, with most Cronbach alpha values falling within .80 to .90.[15] The scale correlates as expected with other scales of HIV/AIDS symptomatology[16] and with clinically important changes among PLWHA.

MOS-HIV (Pain subscale)

The pain subscale is computed by summing the scores on 2 items ("How much bodily pain have you generally had in the past 4 weeks?" "During the past 4 weeks, how much did pain interfere with your normal work?"). The 2 items are reverse scored and the subscale is standardized, such that higher scores indicate less pain and better functioning, relative to the normative sample.

Abstinence

Abstinence was assessed as 24-hour and 7-day point prevalence and at 3-, 6-, and 12-month follow-ups. Self-reported abstinence was biochemically verified by expired carbon monoxide (CO) level of <7 ppm.

Nicotine dependence

The Fagerstrom Test for Nicotine Dependence (FTND) is a 6-item questionnaire that measures nicotine dependence by assessing various components of smoking behavior such as daily intake, difficulty in refraining from smoking, and time to first cigarette of the day.[17] Higher scores indicate higher levels of nicotine dependence. FTND was included as a covariate in the full model.

Data analytic approach

Generalized linear mixed modeling (GLMM), a type of hierarchical linear modeling, was used for the primary analyses in this study. GLMM allows for data to be examined both cross-sectionally and longitudinally and is a widely used approach for assessing repeated outcome data.[18] The primary analyses in this paper were conducted using PROC GLIMMIX in SAS (SAS Institute, Cary, NC), which can account for multilevel models with categorical outcomes (e.g., abstinence).[19]

Results

Participants

The majority of participants were male (70.0%, $n = 332$). The mean age of participants was 44.8 (SD = 8.07) years. The majority of participants (76.58%, $n = 363$) were black/African American. The average number of years that participants had smoked at the time of enrollment was 20.97 (SD = 10.76). Participants smoked an average of 19.15 (SD = 11.54) cigarettes per day at baseline (see Table 1).

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Baseline correlations

The mean Pain subscale score at baseline was 55.91 (SD = 28.36). Baseline pain was not found to be related to age, $t(472) = -.06$, $P = .16$, education $t(472) = .04$, $P = 38$ cigarettes smoked per day at baseline, $t(472) = -.07$, $P = .12$, or years smoked, $t(472) = .08$, $P = .08$. Women reported worse pain than men, $t(472) = -.16$, $P < .01$; the average MOS-HIV Pain subscale *T*-score was 49.06 (SD = 29.60) for women and 58.84 (SD = 27.33) for men. Gender was included as a covariate in the full model.

GLMM results

GLMM was used to examine the relationship between pain and abstinence, from the 3-month treatment end through the 12-month follow-up. An intent-to-treat approach was utilized, such that those individuals who had missing data at follow-ups were coded as "nonabstinent" at that follow-up. Separate GLMM models were run using the GLIMMIX procedure, one model for each measure of abstinence outcome, 24-hour and 7-day. All models controlled for age, gender, time (i.e., 3, 6, and 12 months), baseline pain, nicotine dependence, and treatment group. Less pain (i.e., higher MOS-HIV scores) was associated with greater likelihood of 24-hour ($\beta = .01$, $t(651) = 2.53$, $P = .01$) and 7-day ($\beta = .01$, $t(651) = 2.35$, $P = .02$) abstinence (see Table 2).

No treatment group × pain interactions were found in either of the multilevel models. Time was not found to be related to abstinence outcome in the full model; no time × pain interactions were present. Treatment outcomes are reported elsewhere.[13,14]

Discussion

This study found that lower pain throughout treatment was associated with higher quit rates among PLWHA trying to quit smoking, when controlling for baseline levels of pain and other covariates. A growing literature on pain and smoking suggests that people with pain may be motivated to smoke in order to help cope with pain, at least in the short term.[11,20] It follows that smokers with pain may also have greater difficulty quitting, although this has been the subject of little empirical investigation.[12] This study is the first to demonstrate that PLWHA with higher pain may indeed have poorer quit outcomes. The findings of this study are consistent with initial research in cancer pain demonstrating that greater pain is associated with fewer quit attempts and greater levels of daily smoking among cancer patients with pain who are trying to quit.[12] Taken together, this research suggests that pain, a symptom that is especially common in chronic diseases characterized by high symptom burden such as HIV/AIDS, may be an indicator of poorer success in quitting. Thus, PLWHA who smoke and have pain may require more comprehensive care in quitting.

The results of this study have important clinical implications for PLWHA. If pain is indeed a barrier to quitting in this population, tailored cessation interventions to help PLWHA who smoke to better manage pain may help to improve quit outcomes. However, no research has examined combined treatment for quitting smoking that includes both smoking cessation treatment and pain management. This may be an important area for future investigation.

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Overall, PLWHA in this study with higher pain had poorer quit outcomes. No interaction by experimental group was found. Thus, PLWHA with higher pain did not benefit differentially from those with lower pain from the telephone-based intervention. The content of the telephone-based intervention delivered in this study was not tailored specifically to people dealing with pain. This may help to explain why those participants with higher pain, and presumably greater needs for cessation support, did not benefit more from the intervention than those with lower pain.

This study has some limitations. The analysis did not allow for tests of causality. Higher pain was correlated with lower abstinence throughout the posttreatment follow-up period. Previous research suggests that the pain-smoking relationship may be characterized by bidirectional influences, and it is difficult to determine directionality with the present design.[8] Despite this limitation, this study represents an initial step in better understanding the role of pain in quitting among PLWHA by demonstrating that greater pain is associated with poorer outcomes in smoking cessation treatment. Future research examining real-time assessment of pain, for example, may help to better illuminate pathways and mechanisms in the pain-smoking relationship among PLWHA.

In conclusion, the results of this study identify PLWHA with greater pain as having poorer quit outcomes in a smoking cessation intervention trial. With the mounting evidence linking pain to smoking, there is a need for greater focus on ways in which we can better tailor interventions to meet the needs of smokers. Among PWLHA trying to quit, this may mean integrating aspects of pain and symptom management into smoking cessation treatment.

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Table 1.

Baseline characteristics ($N = 474$).

Baseline characteristics	Mean or %
Age	44.82 (SD = 8.07)
Education (years)	10.85 (SD = 2.61)
Gender (male)	70.0% ($n = 332$)
Treatment group (UC)	50.21% ($n = 238$)
Race	
White	12.45% (n = 59)
Black	76.58% ($n = 363$)
Hispanic	9.07% ($n = 43$)
Other	1.9% ($n = 9$)
HIV transmission	
Men who have sex with men	25.11% ($n = 119$)
Heterosexual contact	45.36% ($n = 215$)
Injection drug use	17.09% ($n = 81$)
Other	12.03% ($n = 57$)
Number of cigarettes smoked per day at baseline	19.15 (SD = 11.54)
Years smoked	20.97 (SD = 10.76)

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Table 2.

Results of multilevel model examining predictors of smoking abstinence.

	24-hour		7-day	
	Estimate	**SE**	**Estimate**	**SE**
Pain	.011, $p = .012$ *	.004	.014, $p = .019$ *	.006
Treatment group (Cell phone intervention is reference group)	−.650, $p = .005$ **	.232	−.520, $p = .078$	.295
Age	.015, $p = .319$	.015	.035, $p = .074$ *	.020
Gender (female is reference group)	−.421, $p = .091$	.248	−.333, $p = .30$	.319
Baseline Pain	−.009, $p = .054$	.005	−.007, $p = .246$	.006
Time, End of Treatment (12-mo. follow-up is reference group)	.326, $p = .173$	.239	.552, $p = .066$	.30
Time, 6-mo. (12-mo. follow-up is reference group)	−.070, $p = .778$	.249	−.079, $p = .807$	.324
Fagerstrom Nicotine Dependence Scale (FTND)	−.251, $p < .001$ **	.051	−.268, $p < .001$ **	.066

* Significant at .01 level.

** Significant at .05 level.